TACSM Abstract

Does the Analysis of Separate Bands of Echo Intensity Strengthen the Relationship to Muscle Function?

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ABSTRACT

Ultrasound echo intensity (EI) has been proposed as a method of assessing muscle quality through the use of non-invasive imaging. Traditionally, EI is assessed as the mean pixel brightness that ranges from 0-255 within an area of interest. However, it may be reasonable to consider that additional portions of the ultrasound EI signal (i.e., bands of signal) may provide novel insight to muscle function. The determination of which band of signal may be more related to a given functional outcome may increase the sensitivity of EI. Thus far, there is no research analyzing the association between EI bands and fatigue. **PURPOSE**: The purpose of this study was to compare relationships between mean echo intensity and unique bands of ultrasound signal of the vastus lateralis with metrics of whole muscle performance in healthy adults. **METHODS**: Twenty-four participants (mean ± age = 22 ± 3.9 yrs; BMI = 25.7 ± 3.4 kg/m^2), completed two visits to the laboratory. On the first visit, subjects completed Brightness mode (B-mode) ultrasound imaging and were familiarized with the fatigue assessment. Between two and seven days later, subjects returned for the testing visit. B-mode ultrasound was used to image the vastus lateralis (VL) at 50% muscle length. The VL cross-sectional area was traced using the polygon tool. As much of the muscle was selected without selecting any of the surrounding fascia. Each pixel is assigned a brightness value from 0-255 based on gray scale; 0 representing true black and 255 is pure white. Mean EI was quantified from within the selected portion of the image. Echo intensity bands were calculated in pixel value intervals of 0-49, 50-99, 100-149, 150-199, 200-255. The percentage of pixels per band compared to the total number of pixels in each image was assessed by: *(number of pixels in each band/ total number of pixels in the selected portion of the image)*100*. For the fatigue assessment, participants completed 100 repeated, maximal, isokinetic muscle actions (120°/sec). Isokinetic peak torque was analyzed offline using custom written software by selecting individual torque peaks from each muscle action. Initial and final isokinetic peak torque were calculated by averaging the highest 3 of the first 5 and the highest 3 of the last 5 contractions. Isokinetic peak torque percent decline (%Decline) was calculated by: *%Decline = (initial – PT – final - PT)/initial - PT*. Pearson's correlation coefficient (*r*) was used to assess the relationship between each EI band and %Decline as well as mean EI and %Decline. The Stieger's Z procedure was used to compare the correlation coefficients between mean EI and each EI band. **RESULTS**: There were no significant correlation between mean EI and %Decline (r=0.03, p=0.88) or any of the EI bands and %Decline (r=-0.07-0.3, p=0.16-0.89). Additionally, there were no significant relationships between the mean EI and any of the EI bands (z=0.001-0.88, p=0.38-0.99). **CONCLUSION**: The findings suggest that unique bands of ultrasound signal do not offer different relationships compared to overall mean EI when assessing fatigue from repetitive isokinetic muscle actions.